Active-Semi

Innovative Green Power Solutions

AC/DC Charger/Adapter Reference Designs
ACT36X, ACT33X

Rev 2.5 Oct 2012

Application Change Note

Revision History	2012-Oct– 19	Rev 2.5
Page 12~13	Update SCH and Transformer (Lp and $N_P/N_S/N_{AUX}$)	
	Update BOM List(C1,C2,R5,R6,R9,R10)	
Page 14~15	Update SCH and Transformer (Lp and $N_P/N_S/N_{AUX}$)	
	Update BOM List(R5,R6,R9,R10)	
Cover page	Change title	

AC/DC Converters – *ActivePSR™*

Applications

- *Chargers for Cell Phones, PDAs, MP3, PMPs, DSCs, and Other Portable Devices*
- *RCC Adapter or Linear Adapter Replacements*
- *Standby and Auxiliary Supplies*
- *White LED Lighting*

Part Number	Output Power	Technology	Standby Power Consumption	Switching Frequency	Package
ACT361	6.0W	PSR①	< 150mW @ VAC = 230V	Adjustable to 40kHz	SOT23-6
ACT364	6.5W	PSR①	< 150mW @ VAC = 230V	Adjustable to 80kHz	SOT23-6
ACT365	12.5W	PSR①	< 150mW @ VAC = 230V	Adjustable to 80kHz	SOP8
ACT366	14.5 W	PSR①	< 150mW @ VAC = 230V	Adjustable to 80kHz	SOP8-EP
ACT334	6.5W	PSR①	< 30mW @ VAC = 230V	Adjustable to 80kHz	SOT23-6
ACT336	7.0W	PSR①	< 30mW @ VAC = 230V	Adjustable to 80kHz	SOP8
ACT337	12.5W	PSR①	< 30mW @ VAC = 230V	Adjustable to 80kHz	SOP8

Table of Contents

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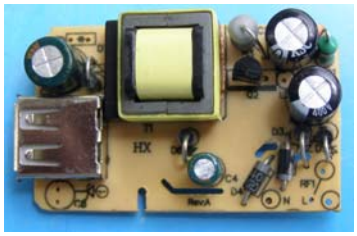
ACT361 5V/1000MA CHARGER

Input Voltage	Device	Standby Power	Output Voltage	Power output	Transformer	Topology
85-264VAC	ACT361	150mW	5V	5W	EE16	Flyback



L=51.0mm
W=31.1mm
H=14.2mm

Operation and Application

Figure 1 is the schematic of an offline charger using ACT361 to provide output power of 5V1000mA. This circuit is a typical flyback power supply which includes the AC rectified circuit (D1-D4,C1, L1, L2, C2),power drive circuit (BD pin, Q1), secondary rectified circuit (D7, C6) and the IC control circuit. ACT361 is a Primary Side Regulator (PSR) so that the power supply unit can regulate current and voltage without Opto-coupler. Pin 4 and Pin 2 are the VDD and ground pins to provide power for the IC. Pin 3 is the base drive for the NPN transistor. Pin 1 is the switching pin. Pin 5 is the feedback pin that senses the output current and output voltage. Pin 6 is the peak current sense pin. Resistance of R7 determines the output DC cord compensation percentage.
This circuit can be used as universal charger for Cell Phones, PDAs, MP3,Portable Media Players, DSCs, and Other Portable Devices and Appliances.

Key Component Selection

The maximum output current is decided by formula(1).

$$I_{OUTCC} = \frac{1}{2} \times L_P \times \left(\frac{0.9 * 0.396}{R_{CS}}\right)^2 \times \left(\frac{\eta \times F_{SW}}{V_{OUTCC}}\right) \qquad (1)$$

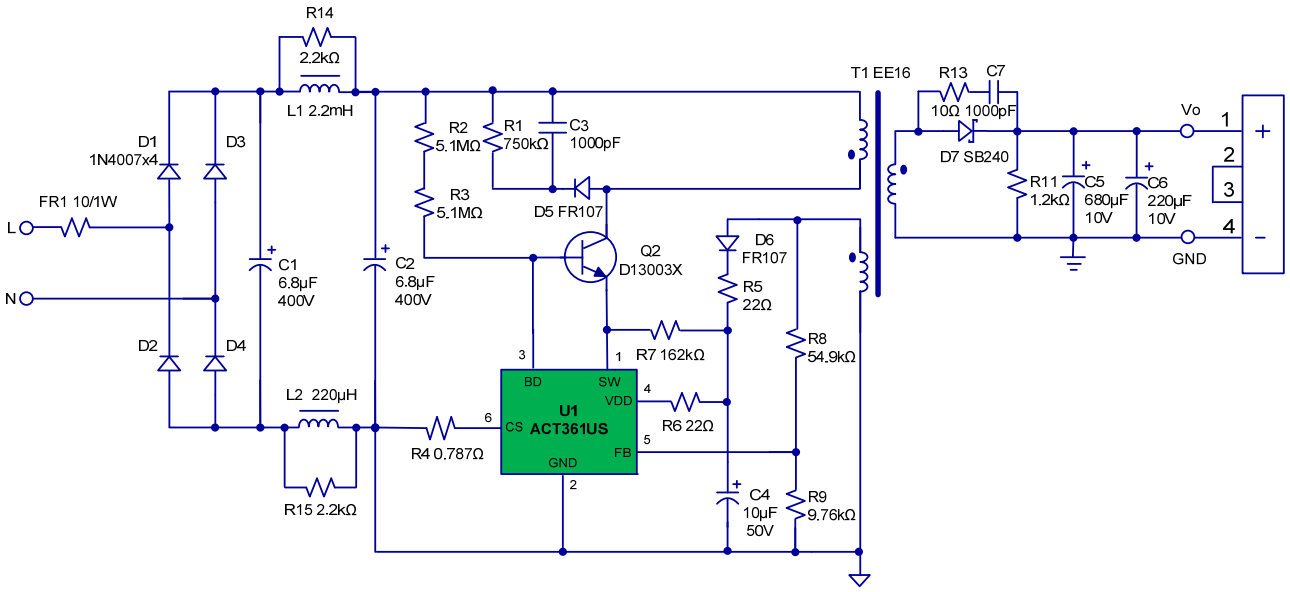
Lp is the transformer inductance value, Rcs is the current sense resistor, which is shown as R4 in the schematic. Fsw is the switching frequency, which design value is 45kHz. ŋ is the overall system efficiency, which value is approximately equal to 70%. Voutcc is the output voltage, which setting is through the flyback voltage of auxiliary winding and the feedback resistor R8, R9 as shown in formula (2).

$$V_{OUTCC} = V_{REF} \times \left(1 + \frac{R_8}{R_9}\right) \times \frac{N_S}{N_{AUX}} - V_{SEC\_R} \qquad (2)$$

Np/Ns/Naux (140/10/14) must be designed correctly to ensure it operates in DCM in all conditions. A design value Voutcc equal to 5V and Ioutcc_min equal to 1000mA are used to do the design. Ns and Naux are number of turns of secondary and auxiliary of the transformer. VSEC_R is the forward voltage drop of the output rectifier diode at approximately 0.1A bias. The peak current limit is set by (0.396×0.9)/Rcs.

Figure 1:

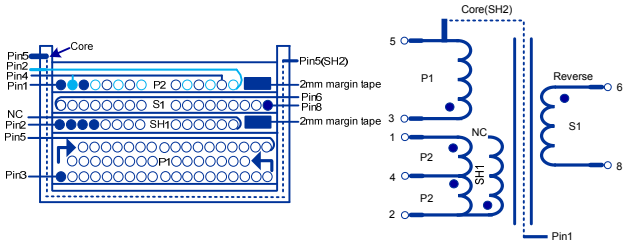
Schematic of Charger



ACT361 5V/1000MA CHARGER

Bill of Materials

REF	DESCRIPTION	MFTR
C1,C2	Capacitor, Electrolytic, 6.8μF/400V, 10x12mm	KSC
C3	Capacitor, Ceramic,1000pF/500V,1206,SMD	POE
C4	Capacitor, Electrolytic,10μF/50V,5x11mm	KSC
C5	Capacitor, Electrolytic, 680μF/10V, 8x12mm	KSC
C6	Capacitor, Electrolytic, 220μF/10V, 5x11mm	KSC
C7	Capacitor, Ceramic,1000pF/50V, 0805, SMD	POE
D1-D4	Diode,Rectifier,1000V/1A,1N4007, DO-41	Good-Ark
D5,D6	Diode,Ultra Fast, FR107,1000V/1.0A, DO-41	Good-Ark
D8	Diode, schottky, 40V/2A, SB210, DO-15	Good-Ark
L1	Axial Inductor, 2.2mH, 0410,Dip	Amode Tech
L2	Axial Inductor, 220μH, 0410,Dip	Amode Tech
Q2	Transistor, HFE 20-25, NPN,D13003X,TO-126	Huawei
PCB1	PCB, L*W*T=58x31.2x1.6mm,Cem-1,Rev:A	Jintong
FR1	Wire Round Resistor,1W,10Ω ,KNP, 5%	TY-OHM
R1	Chip Resistor, 750kΩ, 1206, 5%	TY-OHM
R2,R3	Chip Resistor, 5.1MΩ, 1206, 5%	TY-OHM
R4	Chip Resistor, 0.787Ω, 1206,1%	TY-OHM
R5	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R6	Chip Resistor, 22Ω, 0603, 5%	TY-OHM
R7	Chip Resistor, 162kΩ, 0805, 5%	TY-OHM
R8	Chip Resistor, 54.9kΩ, 0805,1%	TY-OHM
R9	Chip Resistor, 9.76kΩ, 0805, 1%	TY-OHM
R11	Chip Resistor, 1.2kΩ, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
R14,R15	Chip Resistor, 2.2kΩ ohm, 0805, 5%	TY-OHM
T1	Transformer, Lp=1.7mH, EE16	
U1	IC, ACT361,SOT23-6	Active-Semi.
USB	USB, Rev:A	



Build up

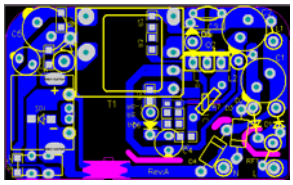
Wind-ing	Terminal		Turns	Wire			Insulation	
	Start	Fin-ish		Type	Size*QTY	Layer	Thick/Wide	Lay er
P1	3	-->	47	2UEW	0.15Φ*1	1	0.025*8.5W	2
	<--	<--	47	2UEW	0.15Φ*1	1	0.025*8.5W	
	-->	5	46	2UEW	0.15Φ*1	1	0.025*8.5W	
SH1	2	NC	8	2UEW	0.12Φ*1	1	0.025*8.5W	2
S1	8	6	10	TEX-E	0.50Φ*1	1	0.025*8.5W	2
P2	4	2	14	2UEW	0.15Φ*2	1	0.025*8.5W	2
	1	4						
SH2	Core	5	1	Conductor	0.15Φ*1	1	0.025*10	2

Note:1.SH1,SH2 are shielding; P1 & P2 are primary and S1 is secondary.(Bobbin:EE16)

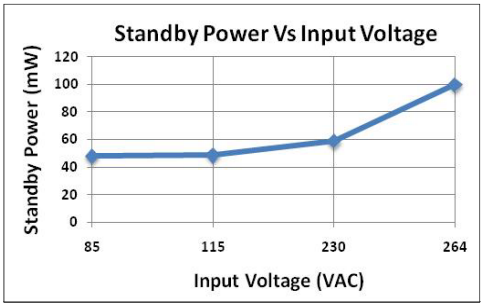
Electrical specifications

Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000Vac
2	P1 Inductance	Inductance between pins 5 and 3 at 1Vac & 1kHz	1.7mH±%7
3	P1 Leakage Inductance	Inductance between pins 3 and 5 with pins 1-2 and 6-8 shorted	75μH

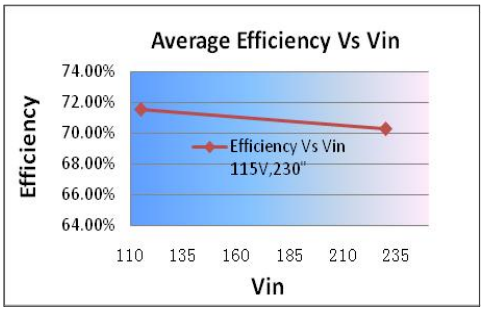
PCB Top and Bottom Layers



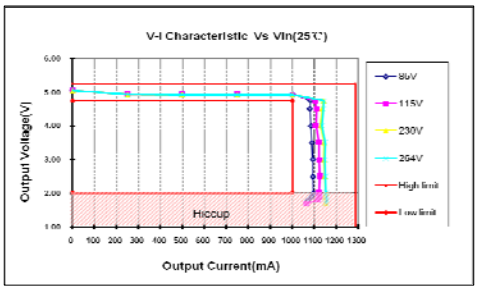
Typical Performance Characteristics



STANDBY POWER



EFFICIENCY

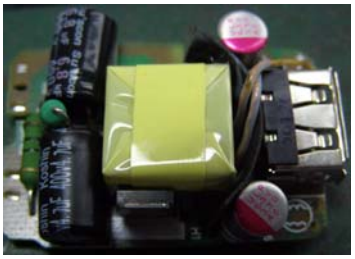


CC/CV CURVE

EVALUATION KITS	Vin	Vo	Io
ACT361-01	85-264Vac	4.75-5.25V	1000-1268mA

ACT364 5V/1000MA CHARGER

Input Voltage	Device	Standby Power	Output Voltage	Power output	Transformer	Topology
85-264VAC	ACT364	150mW	5V	5W	EPC13	Flyback



L=41.3mm
W=28.1mm
H=13.2mm

Operation and Application

Figure 1 is the schematic of an offline charger using ACT364 to provide output power of 5V1000mA. This circuit is a typical flyback power supply which includes the AC rectified circuit (BD1,C1, L1,C2),power drive circuit (BD pin, Q1), secondary rectified circuit (D8,C5,C6) and the IC control circuit. ACT364 is a Primary Side Regulator (PSR) so that the power supply unit can regulate current and voltage without Opto-coupler. Pin 4 and Pin 2 are the VDD and ground pins to provide power for the IC. Pin 3 is the base drive for the NPN transistor. Pin 1 is the switching pin. Pin 5 is the feedback pin that senses the output current and output voltage. Pin 6 is the peak current sense pin. Resistance of R10 determines the output DC cord compensation percentage.
This circuit can be used as universal charger for Cell Phones, PDAs, MP3,Portable Media Players, DSCs, and Other Portable Devices and Appliances.

Key Component Selection

The maximum output current is decided by formula(1).

$$I_{OUTCC} = \frac{1}{2} \times L_P \times \left(\frac{0.9 * 0.396}{R_{CS}}\right)^2 \times \left(\frac{\eta \times F_{SW}}{V_{OUTCC}}\right) \qquad (1)$$

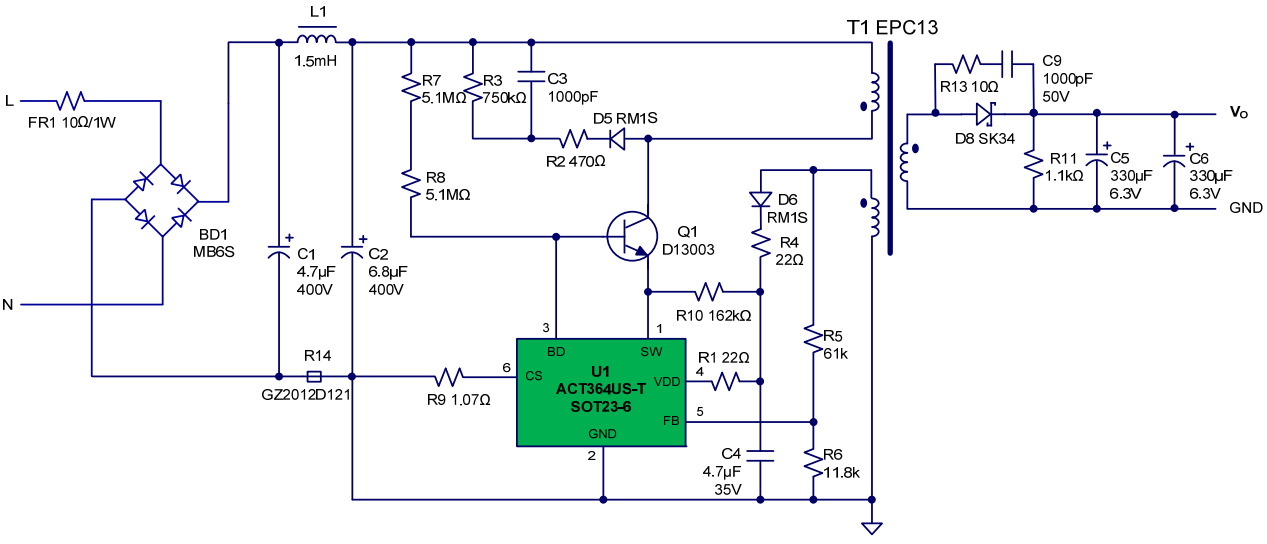
Lp is the transformer inductance value, Rcs is the current sense resistor, which is shown as R9 in the schematic. Fsw is the switching frequency, which design value is 75kHz. η is the overall system efficiency, which value is approximately equal to 70%. Voutcc is the output voltage, which setting is through the flyback voltage of auxiliary winding and the feedback resistor R5, R6 as shown in formula (2).

$$V_{OUTCC} = V_{REF} \times \left(1 + \frac{R_5}{R_6}\right) \times \frac{N_S}{N_{AUX}} - V_{SEC\_R} \qquad (2)$$

Np/Ns/Naux (147/9/24) must be designed correctly to ensure it operates in DCM in all conditions. A design value Voutcc equal to 5V and Ioutcc_min equal to 1000mA are used to do the design. Ns and Naux are number of turns of secondary and auxiliary of the transformer. VSEC_R is the forward voltage drop of the output rectifier diode at approximately 0.1A bias. The peak current limit is set by (0.396×0.9)/Rcs.

Figure 1:

Schematic of Charger

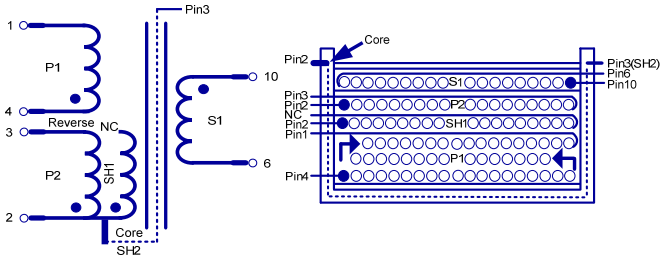


ACT364 5V/1000MA CHARGER

Bill of Materials

REF	DESCRIPTION	MFTR
C1	Capacitor, Electrolytic, 4.7μF/400V,8 ×12mm	Koshin
C2	Capacitor, Electrolytic, 6.8μF/400V,8 ×12mm	Koshin
C3	Capacitor, Ceramic,1000pF/500V,1206,SMD	POE
C4	Capacitor, Ceramic,4.7uF/35V,0805,SMD	POE
C5,C6	Capacitor, Solid, 330μF/6.3V, 6.3 ×9mm	KSC
C9	Capacitor, Ceramic,1000pF/50V,0805,SMD	POE
BD1	Bridge,B6S,600V/0.5A,MDI,SMD	PANJIT
D5,D6	Diode, Ultra Fast, RS1M,1000V/1.0A, SMA	Good-Ark
D8	Diode, Schottky, 40V/3A, SK34, SMB	Good-Ark
L1	Axial Inductor, 1.5mH, 0410, DIP	Amode Tech
Q1	Transistor, NPN, 700V,1.5A, D13003, TO-251AB	Huawei
PCB1	PCB, L*W*T=42x28 x1.0mm, FR-4,Rev:ACT364_00_1	Jintong
FR1	Fusible Resistor, 1W, 10Ω, 5%	TY-OHM
R1,R4	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R2	Chip Resistor, 470Ω, 0805, 5%	TY-OHM
R3	Chip Resistor, 750k Ω, 0805, 5%	TY-OHM
R5	Chip Resistor, 61k Ω, 0805, 1%	TY-OHM
R6	Chip Resistor, 11. 8kΩ, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 5.1MΩ, 0805, 5%	TY-OHM
R9	Chip Resistor, 1.07Ω, 1206, 1%	TY-OHM
R10	Chip Resistor, 162k, 0805, 5%	TY-OHM
R11	Chip Resistor, 1.1k, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
R14	Bead, GZ2012D121,0805	KC
T1	Transformer, L_P = 1.75mH±7%, EPC13	
U1	IC, ACT364US-T, SOT23-6	Active-Semi

Transformer Specitication



Build up

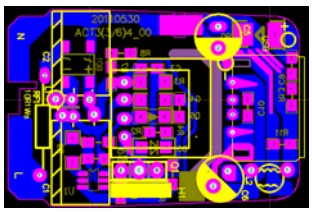
Wind-ing	Terminal		Turns	Wire			Insulation	
	Start	Fin-ish		Type	Size*QTY	Layer	Thick/Wide	Lay er
P1	4	-->	49	2UEW	0.12Φ*1	1	0.025*8.5W	
	<--	<--	49	2UEW	0.12Φ*1	1	0.025*8.5W	
	-->	1	49	2UEW	0.12Φ*1	1	0.025*8.5W	
SH1	2	NC	49	2UEW	0.12Φ*1	1	0.025*8.5W	
P2	2	3	24	2UEW	0.12Φ*1	1	0.025*8.5W	1
S1	10	6	9	TEX-E	0.40Φ*1	1	0.025*8.5W	2
SH2	2	Core	1					3

Note:1.SH1,SH2 are shielding; P1 & P2 are primary and S1 is secondary.(Bobbin:EPC13)

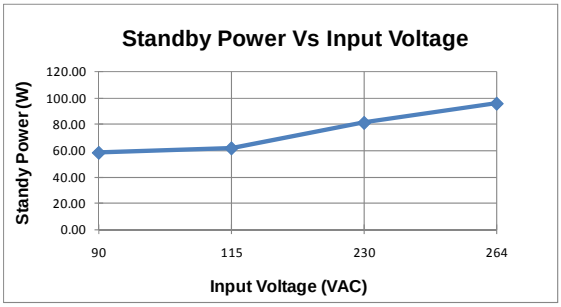
Electrical specifications

Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000Vac
2	P1 Inductance	Inductance between pins 1 and 4 at 1Vac & 1kHz	1.75mH±%7
3	P1 Leakage Inductance	Inductance between pins 1 and 4 with pins 2-3 and 6-10 shorted	75μH

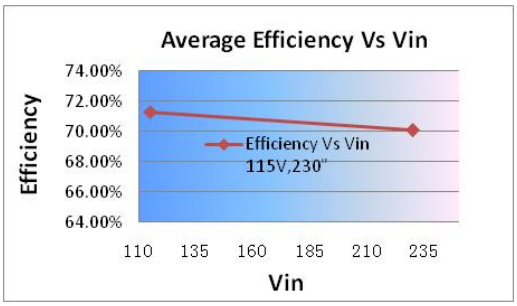
PCB Top and Bottom Layers



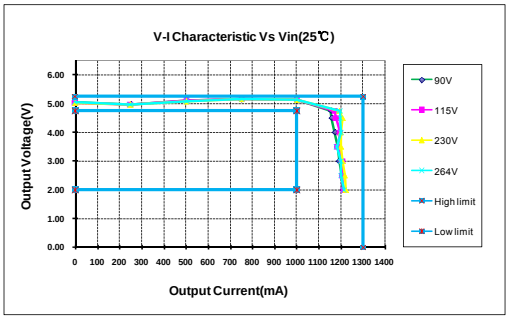
Typical Performance Characteristics



STANDBY POWER



EFFICIENCY



CC/CV CURVE

EVALUATION KITS	Vin	Vo	Io
ACT364_00_1	85-264Vac	4.75-5.25V	1000-1300mA

ACT365 5V/2100MA CHARGER

Input Voltage	Device	Standby Power	Output Voltage	Power output	Transformer	Topology
85-264VAC	ACT365SH	150mW	5V	10.5W	EPC17	Flyback

L=40.0mm
W=28.1mm
H=22.1mm

Operation and Application

Figure 1 is the schematic of an offline charger using ACT365 to provide output power of 5V2100mA. This circuit is a typical flyback power supply which includes the AC rectified circuit (BD1,C1, C2),power drive circuit (BD pin, Q1), secondary rectified circuit (D8, C5,C6) and the IC control circuit. ACT365SH is a Primary Side Regulator (PSR) so that the power supply unit can regulate current and voltage without Opto-coupler. Pin 6 and Pin 2,4,7 are the VDD and ground pins to provide power for the IC. Pin 8 is the base drive for the NPN transistor. Pin 1 is the switching pin. Pin 5 is the feedback pin that senses the output current and output voltage. Pin 3 is the peak current sense pin. Resistance of R10 determines the output DC cord compensation percentage. This circuit can be used as universal charger for Cell Phones, PDAs, MP3,Portable Media Players, Shaver, DSCs, and Other Portable Devices and Appliances.

Key Component Selection

The maximum output current is decided by formula (1).

$$I_{OUTCC} = \frac{1}{2} \times L_P \times \left(\frac{0.9 * 0.396}{R_{CS}}\right)^2 \times \left(\frac{\eta \times F_{SW}}{V_{OUTCC}}\right) \quad (1)$$

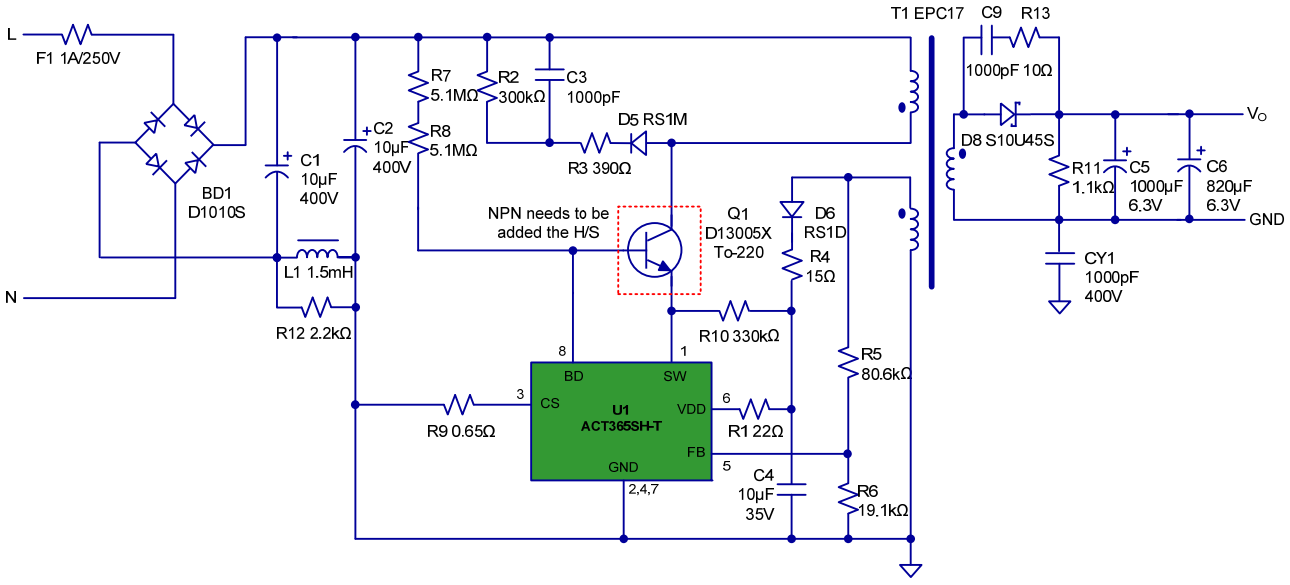
Lp is the transformer inductance value, Rcs is the current sense resistor, which is shown as R9 in the schematic. Fsw is the switching frequency, which design value is 75kHz. η is the overall system efficiency, which value is approximately equal to 70%. Voutcc is the output voltage, which setting is through the flyback voltage of auxiliary winding and the feedback resistor R5, R6 as shown in formula (2).

$$V_{OUTCC} = V_{REF} \times \left(1 + \frac{R_5}{R_6}\right) \times \frac{N_S}{N_{AUX}} - V_{SEC\_R} \quad (2)$$

Np/Ns/Naux (110/8/18) must be designed correctly to ensure it operates in DCM in all conditions. A design value Voutcc equal to 5V and Ioutcc_min equal to 2100mA are used to do the design. Ns and Naux are number of turns of secondary and auxiliary of the transformer. VSEC_R is the forward voltage drop of the output rectifier diode at approximately 0.1A bias. The peak current limit is set by (0.396×0.9)/Rcs.

Figure 1:

Schematic of Charger

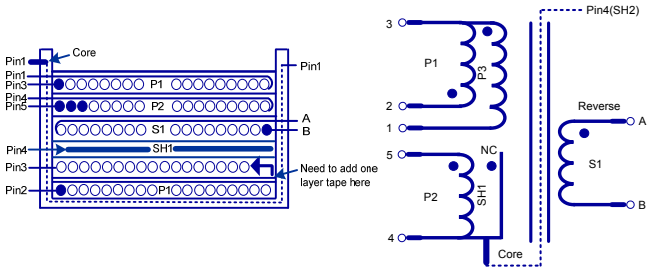


ACT365 5V/2100MA CHARGER

Bill of Materials

REF	DESCRIPTION	MFTR
C1, C2	Capacitor, Electrolytic, 10μF/400V, 10×16mm	KSC
C3	Capacitor, Ceramic,1000pF/500V,1206,SMD	POE
C4	Capacitor, Ceramic, 10μF/35V,1206,SMD	KSC
C5	Capacitor, Electrolytic, 1000μF/6.3V, 8 ×16mm	KSC
C6	Capacitor, Electrolytic, 820μF/6.3V, 6.3 × 16mm	KSC
C9	Capacitor, Ceramic,1000pF/50V,0805,SMD	POE
CY1	Safety Y1,Capacitor,1000pF/400V,Dip	UXT
BD1	Bridge Rectifier,D1010S,1000V/1.0A,SDIP	PANJIT
D5	Fast Recovery Rectifier, RS1M,1000V/1.0A, RMA	PANJIT
D6	Fast Recovery Rectifier,RS1D,200V/1.0A,SMA	PANJIT
D8	Diode, Schottky, 45V/10A, S10U45S, SMD	Diodes
L1	Choke Coil, 1.5mH, ¢6x8mm, DIP	Amode
PCB1	PCB, L*W*T=40x28.1x1.6mm,Cem-1,Rev:A	Jintong
Q1	Transistor, NPN, 700V,D13005,TO-126	Huawei
F1	Fuse:1A 250V 3.6*10mm With Pigtail, ceramic tube	walter
R1	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R2	Chip Resistor, 300k,1206, 5%	TY-OHM
R3	Chip Resistor, 390Ω,1206, 5%	TY-OHM
R4	Chip Resistor, 15Ω, 0805, 5%	TY-OHM
R5	Chip Resistor, 80.6k,0805, 1%	TY-OHM
R6	Chip Resistor,19.1k,0805, 1%	TY-OHM
R7	Chip Resistor, 10MΩ, 1206, 5%	TY-OHM
R9	Chip Resistor, 0.65Ω,1206, 1%	TY-OHM
R10	Chip Resistor, 162k,0805, 5%	TY-OHM
R11	Chip Resistor, 1.1k, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
T1	Transformer, L_P = 1.25mH±7%, EPC17	
USB	Double-layer USB Rev:A	
S/H1	AL HeatSink, LxWxH=7.5x17x2.0mm	
U1	IC, ACT365SH-T, SOP-8	ACT

Transformer Specitication



Build up

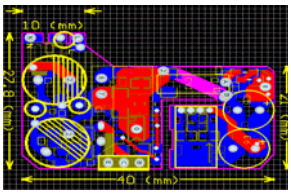
Wind-ing	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QTY	Layer	Thick/Wide	Layer
P1	2	3	74	2UEW	0.22Φ*1	1	0.025*8.5W	2
SH1	-->	4	0.9	Copper	0.7mm	1	0.025*8.5W	2
S1	B	A	8	TEX-E	0.75Φ*1	1	0.025*8.5W	2
P2	5	4	18	2UEW	0.14¢*3	1	0.025*8.5W	2
P3	3	1	36	2UEW	0.22¢*1	1	0.025*8.5W	2
SH2	4	core	3	Copper wire	0.15Φ*1	1	0.025*8.5W	5

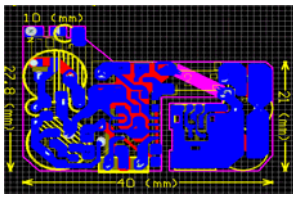
Note:1.SH1,SH2 are shielding; P1, P2 are primary and S1 is secondary.(Bobbin:EPC17)

Electrical Specifications

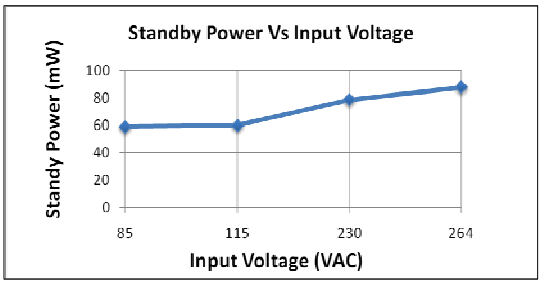
Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secon-dary	3000Vac
2	P1 Inductance	Inductance between pins 1 and 3 at 1Vac & 1kHz	1.25mH±%7
3	P1 Leakage Inductance	Inductance between pins 1 and 3 with pins 4-5 and A-B shorted	75μH

PCB Top and Bottom Layers

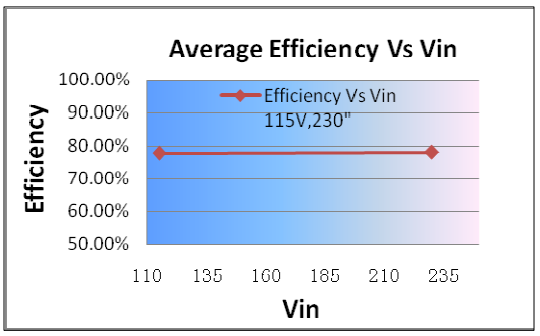




Typical Performance Characteristics



STANDBY POWER

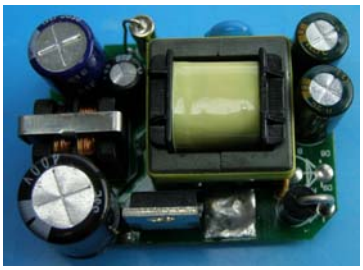


EFFICIENCY

EVALUATION KITS	Vin	Vo	Io
ACT365-01	85-264Vac	4.75-5.25V	>2100mA

ACT366 12V/1000MA CHARGER

Input Voltage	Device	Standby Power	Output Voltage	Power output	Transformer	Topology
85-264VAC	ACT366HY	150mW	12V	12W	EE20	Flyback



L=45.8mm
W=33.3mm
H=22.4mm

Operation and Application

Figure 1 is the schematic of an offline charger using ACT366YH to provide output power of 12V1000mA. This circuit is a typical flyback power supply which includes the AC rectified circuit (BD1,C1, C2),power drive circuit (BD pin, Q1), secondary rectified circuit (D8, C5,C6) and the IC control circuit. ACT366YH is a Primary Side Regulator (PSR) so that the power supply unit can regulate current and voltage without Opto-coupler. Pin 6 and Pin 2,4,7 are the VDD and ground pins to provide power for the IC. Pin 8 is the base drive for the NPN transistor. Pin 1 is the switching pin. Pin 5 is the feedback pin that senses the output current and output voltage. Pin 3 is the peak current sense pin. Resistance of R10 determines the output DC cord compensation percentage. This circuit can be used as universal charger for Cell Phones,PDAs, MP3,Portable Media Players, Shaver, DSCs, and Other Portable Devices and Appliances.

Key Component Selection

The maximum output current is decided by formula (1).

$$I_{OUTCC} = \frac{1}{2} \times L_P \times (\frac{0.9 * 0.396}{R_{CS}})^2 \times (\frac{\eta \times F_{SW}}{V_{OUTCC}}) \quad (1)$$

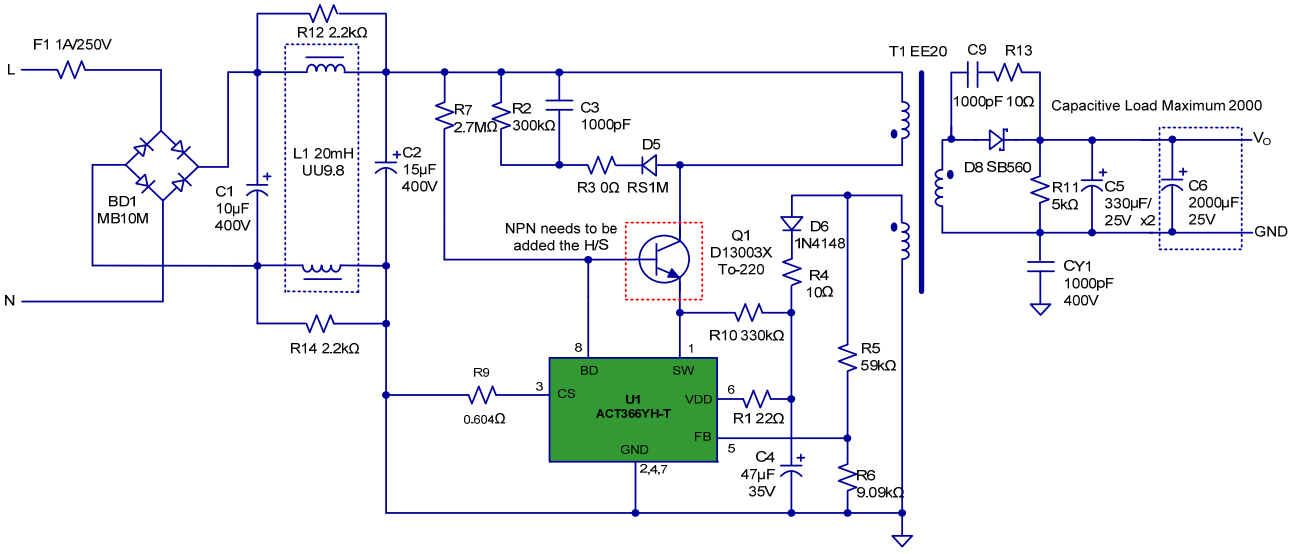
Lp is the transformer inductance value, Rcs is the current sense resistor, which is shown as R9 I the schematic. Fsw is the switchin frquency,which design value is 75kHz. η is the overall system efficiency, which value is approximately equal to 70%. Voutcc is the output voltage, which setting is through the flyback voltage of auxiliary winding and the feedback resistor R5, R6 as shown in formula (2).

$$V_{OUTCC} = V_{REF} \times (1 + \frac{R_5}{R_6}) \times \frac{N_S}{N_{AUX}} - V_{SEC\_R} \quad (2)$$

Np/Ns/Naux (96/9/12) must be designed correctly to ensure it operates in DCM in all conditions. A design value Voutcc equal to 12V and Ioutcc_min equal to 1000mA are used to do the design. Ns and Naux are number of turns of secondary and auxiliary of the transformer. VSEC_R is the forward voltage drop of the output rectifier diode at approximately 0.1A bias. The peak current limit is set by (0.396×0.9)/Rcs.

Figure 1:

Schematic of Charger

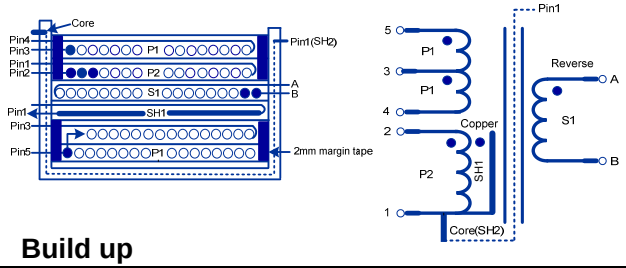


ACT366 12V/1000MA CHARGER

Bill of Materials

REF	DESCRIPTION	MFTR
C1	Capacitor, Electrolytic, 10μF/400V, 10 × 12mm	KSC
C2	Capacitor, Electrolytic, 15μF/400V, 10 × 12mm	KSC
C3	Capacitor, Ceramic,1000pF/500V,1206, SMD	POE
C4	Capacitor, Electrolytic, 47μF/35V, 5 × 11mm	KSC
C5	Capacitor, Electrolytic, 330μF/25V, 8 × 12mm?	KSC
C9	Capacitor, Ceramic,1000pF/50V,0805,SMD	POE
CY1	Safety Y1,Capacitor,1000pF/400V,Dip	UXT
BD1	Bridge,Rectifier,1000V/1A,MB10M, SMD	
D5	Diode, Ultra Fast, FR107,1000V/1.0A, DO-41	Good-Ark
D6	Diode, Switching,75V/150mA,LL4148, MICRO-MELF	Good-Ark
D8	Diode, Schottky, 60V/5A, SB560, DO-201AD	PANJIT
L1	Common choke mode, UU9.8,20mH, DIP	
PCB1	PCB, L*W*T=45.8x33.3x1.6mm,Cem-1,Rev:A	Jintong
Q1	Transistor, NPN, 700V,1.5A, D13003, TO-220	Huawei
F1	Fuse:1A 250V 3.6*10mm With Pigtail, ceramic tube	walter
R1	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R2	Chip Resistor, 300k, 1206, 5%	TY-OHM
R3	Chip Resistor, 0Ω, 1206, 5%	TY-OHM
R4	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
R5	Chip Resistor, 59k, 0805, 1%	TY-OHM
R6	Chip Resistor, 9.09k, 0805, 1%	TY-OHM
R7	Chip Resistor, 2.7MΩ, 1206, 5%	TY-OHM
R9	Chip Resistor, 0.604Ω, 1206, 1%	TY-OHM
R10	Chip Resistor, 330k, 0805, 5%	TY-OHM
R11	Chip Resistor, 5K, 0805, 5%	TY-OHM
R12,R14	Chip Resistor, 2.2K, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
T1	Transformer, L_P = 1.2mH±7%, EE20	
S/H1	AL HeatSink, LxWxH=15x23x2.0mm	
U1	IC, ACT366YH-T, SOP8-EP	Active-Semi

Transformer Specitication



Build up

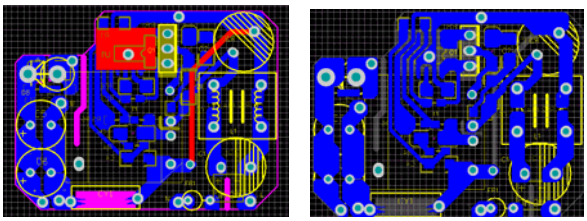
Wind-ing	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QTY	Layer	Thick/Wide	Laye r
P1	5	-->	32	2UEW	0.25Φ*1	1	0.025*8.5W	
	-->	3	32	2UEW	0.25Φ*1	1	0.025*8.5W	2
SH1	-->	1	0.9	Copper	0.7mm	1	0.025*8.5W	2
S1	B	A	9	TEX-E	0.4Φ*2	1	0.025*8.5W	2
P2	2	1	12	2UEW	0.25Φ*3	1	0.025*8.5W	2
P1	3	4	32	2UEW	0.25Φ*1	1	0.025*8.5W	2
SH2	1	core	3	Con-ductor	0.25Φ*1	1	0.025*10	5

Note:1.SH1 and SH2 are shielding; P1 & P2 are primary and S1 is secondary.(Bobbin:EE20)

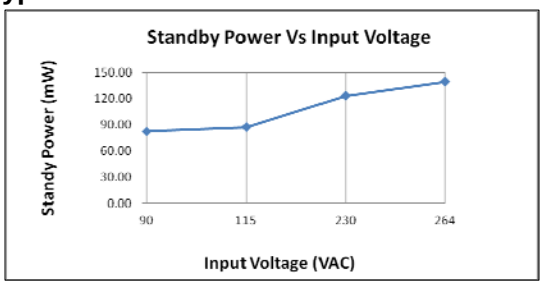
Electrical specifications

Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000Vac
2	P1 Inductance	Inductance between pins 4 and 5 at 1Vac & 1kHz	1.2mH±%7
3	P1 Leakage Inductance	Inductance between pins 4 and 5 with pins 2-1 and A-B shorted	75μH

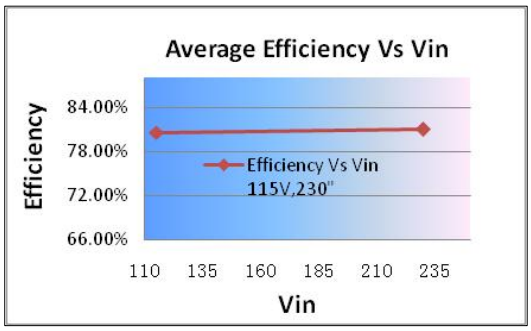
PCB Top and Bottom Layers



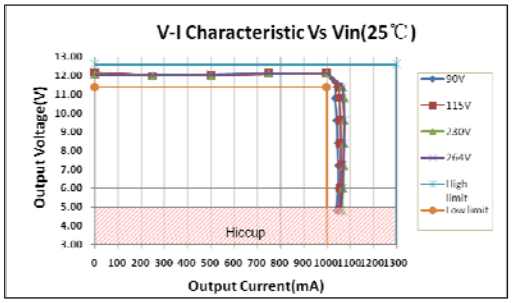
Typical Performance Characteristics



STANDBY POWER



EFFICIENCY

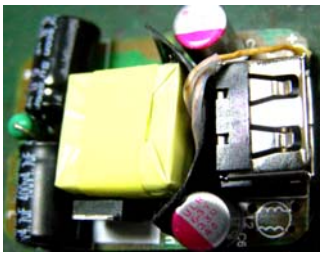


CC/CV CURVE

EVALUATION KITS	Vin	Vo	Io
ACT366-01	85-264Vac	11.4-12.6V	>1000mA

ACT334 5V/700MA CHARGER

Input Voltage	Device	Standby Power	Output Voltage	Power output	Transformer	Topology
85-264VAC	ACT334	30mW	5V	3.5W	EPC13	Flyback



L=41.3mm
W=28.1mm
H=13.2mm

Operation and Application

Figure 1 is the schematic of an offline charger using ACT334 to provide output power of 5V/700mA. This circuit is a typical flyback power supply which includes the AC rectified circuit (D1,D2,D3,D4,C1,L1, C2),power drive circuit (BD pin, Q1), secondary rectified circuit (D8, C5,C6) and the IC control circuit. ACT334 is a Primary Side Regulator (PSR) so that the power supply unit can regulate current and voltage without Opto-coupler. Pin 4 and Pin 2 are the VDD and ground pins to provide power for the IC. Pin 3 is the base drive for the NPN transistor. Pin 1 is the switching pin. Pin 5 is the feedback pin that senses the output current and output voltage. Pin 6 is the peak current sense pin. Resistance of R10 determines the output DC cord compensation percentage.

This circuit can be used as universal charger for Cell Phones, PDAs, MP3,Portable Media Players, DSCs, and Other Portable Devices and Appliances.

Key Component Selection

The maximum output current is decided by formula(1).

$$I_{OUTCC} = \frac{1}{2} \times L_P \times (\frac{0.9 * 0.396}{R_{CS}})^2 \times (\frac{\eta \times F_{SW}}{V_{OUTCC}}) \quad (1)$$

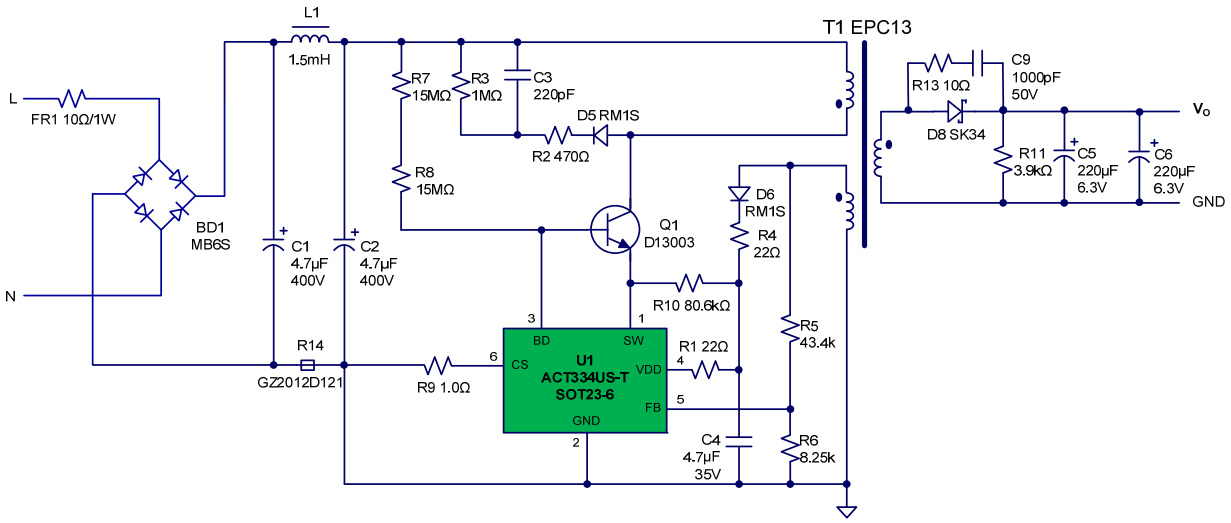
Lp is the transformer inductance value, Rcs is the current sense resistor, which is shown as R9 in the schematic. Fsw is the switching frequency, which design value is 75kHz. η is the overall system efficiency, which value is approximately equal to 70%. Voutcc is the output voltage, which setting is through the flyback voltage of auxiliary winding and the feedback resistor R5, R6 as shown in formula (2).

$$V_{OUTCC} = V_{REF} \times (1 + \frac{R_5}{R_6}) \times \frac{N_S}{N_{AUX}} - V_{SEC\_R} \quad (2)$$

Np/Ns/Naux (147/9/24) must be designed correctly to ensure it operates in DCM in all conditions. A design value Voutcc equal to 5V and Ioutcc_min equal to 700mA are used to do the design. Ns and Naux are number of turns of secondary and auxiliary of the transformer. VSEC_R is the forward voltage drop of the output rectifier diode at approximately 0.1A bias. The peak current limit is set by (0.396×0.9)/Rcs

Figure 1:

Schematic of Charger

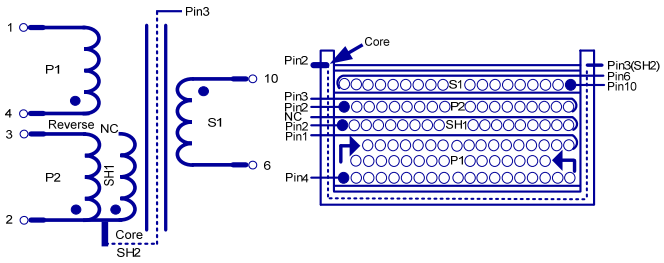


ACT334 5V/700MA CHARGER

Bill of Materials

REF	DESCRIPTION	MFTR
C1, C2	Capacitor, Electrolytic, 4.7μF/400V, 8 × 12mm	KSC
C3	Capacitor, Ceramic,220pF/500V,1206,SMD	POE
C4	Capacitor, Ceramic,, 4.7μF/35V, 1206, SMD	POE
C5,C6	Capacitor, Electrolytic, 220μF/10V, 6.3 × 8mm	KSC
C9	Capacitor, Ceramic,1000pF/50V,0805,SMD	POE
D1-D5	Diode,Rectifier,1000V/1A,1N4007, DO-41	Good-Ark
D6	Diode, Ultra Fast, FR107,1000V/1.0A, DO-41	Good-Ark
D8	Diode, Schottky, 40V/3A, SB340, SMA	Good-Ark
L1	Axial Inductor, 1.5mH, 0410, DIP	Amode Tech
PCB1	PCB, L*W*T=41.3x28.1x1.6mm,Cem-1,Rev:A	Jintong
Q1	Transistor, NPN, 700V,1.5A, D13003, TO-251AB	Huawei
FR1	Fusible Resistor, 1W, 10Ω, 5%	TY-OHM
R1,R4	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R2	Chip Resistor, 1.0M, 1206, 5%	TY-OHM
R3	Chip Resistor, 470Ω, 1206, 5%	TY-OHM
R5	Chip Resistor, 43.4K, 0805, 1%	TY-OHM
R6	Chip Resistor, 8.25K, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 15MΩ, 1206, 5%	TY-OHM
R9	Chip Resistor, 1.0Ω, 1206, 1%	TY-OHM
R10	Chip Resistor, 80.6K, 0805, 5%	TY-OHM
R11	Chip Resistor, 3.9K, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
T1	Transformer, L_P = 1.5mH±7%, EPC13 5+5pin	
U1	IC, ACT334US-T, SOT23-6	Active-Semi

Transformer Specitication



Build up

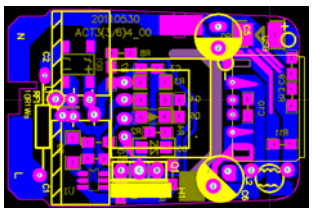
Wind-ing	Terminal		Turns	Wire			Insulation	
	Start	Fin-ish		Type	Size*QTY	Layer	Thick/Wide	Lay er
P1	4	-->	49	2UEW	0.12Φ*1	1	0.025*8.5W	
	<--	<--	49	2UEW	0.12Φ*1	1	0.025*8.5W	
	-->	1	49	2UEW	0.12Φ*1	1	0.025*8.5W	
SH1	2	NC	49	2UEW	0.12Φ*1	1	0.025*8.5W	
P2	2	3	24	2UEW	0.12Φ*1	1	0.025*8.5W	1
S1	10	6	9	TEX-E	0.40Φ*1	1	0.025*8.5W	2
SH2	2	Core	1					3

Note:1.SH1,SH2 are shielding; P1 & P2 are primary and S1 is secondary.(Bobbin:EPC13)

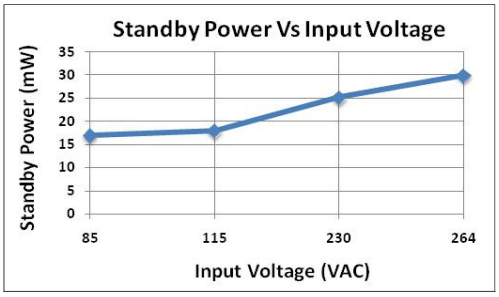
Electrical specifications

Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000Vac
2	P1 Inductance	Inductance between pins 1 and 4 at 1Vac & 1kHz	1.5mH±%7
3	P1 Leakage Inductance	Inductance between pins 1 and 4 with pins 2-3 and 6-10 shorted	75μH

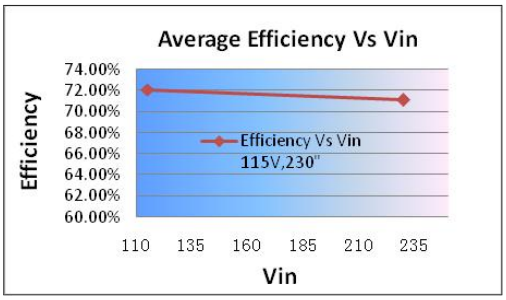
PCB Top and Bottom Layers



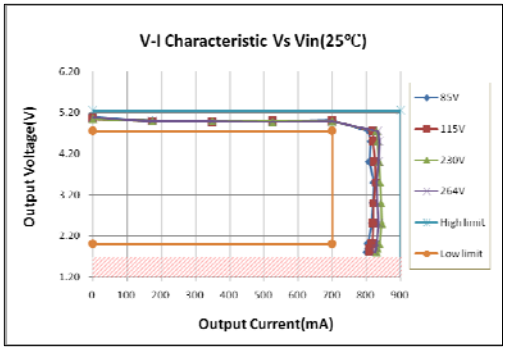
Typical Performance Characteristics



STANDBY POWER



EFFICIENCY

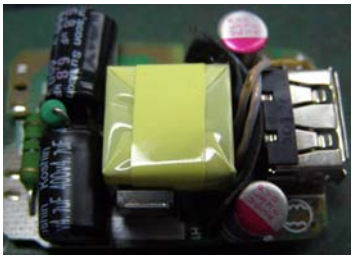


CC/CV CURVE

EVALUATION KITS	Vin	Vo	Io
ACT334-01	85-264Vac	4.75-5.25V	700-900mA

ACT334 5V/1000MA CHARGER

Input Voltage	Device	Standby Power	Output Voltage	Power output	Transformer	Topology
85-264VAC	ACT334	30mW	5V	5W	EPC13	Flyback



L=41.3mm
W=28.1mm
H=13.2mm

Operation and Application

Figure 1 is the schematic of an offline charger using ACT334 to provide output power of 5V1000mA. This circuit is a typical flyback power supply which includes the AC rectified circuit (D1,D2,D3,D4,C1, L1, C2),power drive circuit (BD pin, Q1), secondary rectified circuit (D8, C5,C6) and the IC control circuit. ACT334 is a Primary Side Regulator (PSR) so that the power supply unit can regulate current and voltage without Opto-coupler. Pin 4 and Pin 2 are the VDD and ground pins to provide power for the IC. Pin 3 is the base drive for the NPN transistor. Pin 1 is the switching pin. Pin 5 is the feedback pin that senses the output current and output voltage. Pin 6 is the peak current sense pin. Resistance of R10 determines the output DC cord compensation percentage.

This circuit can be used as universal charger for Cell Phones, PDAs, MP3,Portable Media Players, DSCs, and Other Portable Devices and Appliances.

Key Component Selection

The maximum output current is decided by formula(1).

$$I_{OUTCC} = \frac{1}{2} \times L_P \times (\frac{0.9 * 0.396}{R_{CS}})^2 \times (\frac{\eta \times F_{SW}}{V_{OUTCC}}) \quad (1)$$

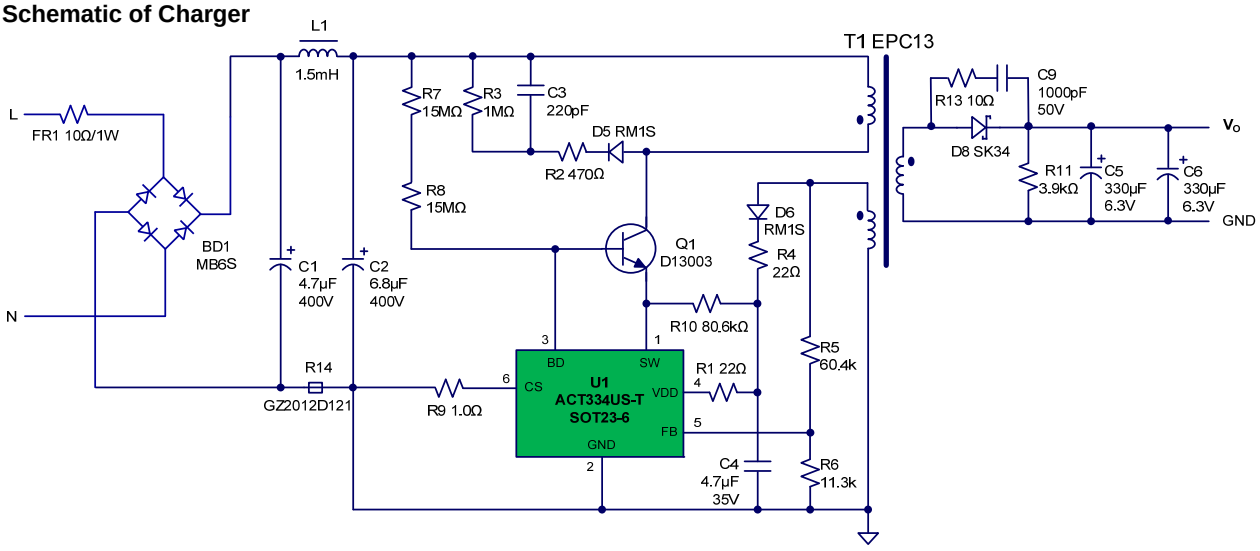
Lp is the transformer inductance value, Rcs is the current sense resistor, which is shown as R9 in the schematic. Fsw is the switching frequency, which design value is 75kHz. η is the overall system efficiency, which value is approximately equal to 70%. Voutcc is the output voltage, which setting is through the flyback voltage of auxiliary winding and the feedback resistor R5, R6 as shown in formula (2).

$$V_{OUTCC} = V_{REF} \times (1 + \frac{R_5}{R_6}) \times \frac{N_S}{N_{AUX}} - V_{SEC\_R} \quad (2)$$

Np/Ns/Naux (147/9/24) must be designed correctly to ensure it operates in DCM in all conditions. A design value Voutcc equal to 5V and Ioutcc_min equal to 1000mA are used to do the design. Ns and Naux are number of turns of secondary and auxiliary of the transformer. VSEC_R is the forward voltage drop of the output rectifier diode at approximately 0.1A bias. The peak current limit is set by (0.396×0.9)/Rcs

Figure 1:

Schematic of Charger

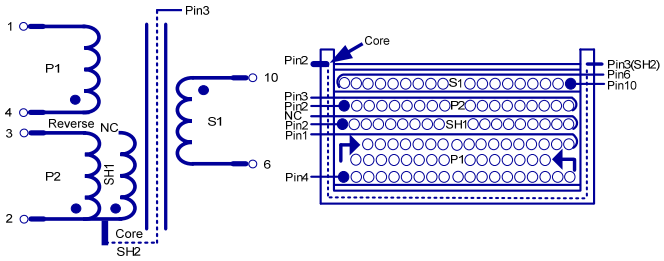


ACT334 5V/1000MA CHARGER

Bill of Materials

REF	DESCRIPTION	MFTR
C1, C2	Capacitor, Electrolytic, 6.8μF/400V, 8 × 12mm	KSC
C3	Capacitor, Ceramic,220pF/500V,1206,SMD	POE
C4	Capacitor, Ceramic,, 4.7μF/35V, 1206, SMD	POE
C5,C6	Capacitor, Electrolytic, 330μF/10V, 6.3 × 8mm	KSC
C9	Capacitor, Ceramic,1000pF/50V,0805,SMD	POE
D1-D5	Diode,Rectifier,1000V/1A,1N4007, DO-41	Good-Ark
D6	Fast Recovery Rectifier,RS1D,200V/1.0A,SMA	Good-Ark
D8	Diode, Schottky, 40V/3A, SB340, SMA	Good-Ark
L1	Axial Inductor, 1.5mH, 0410, DIP	Amode Tech
PCB1	PCB, L*W*T=41.3x28.1x1.6mm,Cem-1,Rev:A	Jintong
Q1	Transistor, NPN, 700V,1.5A, D13003, TO-251AB	Huawei
FR1	Fusible Resistor, 1W, 10Ω, 5%	TY-OHM
R1,R4	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R2	Chip Resistor, 1.0MΩ, 1206, 5%	TY-OHM
R3	Chip Resistor, 470Ω, 1206, 5%	TY-OHM
R5	Chip Resistor, 60.4kΩ, 0805, 1%	TY-OHM
R6	Chip Resistor, 11.3kΩ, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 15MΩ, 1206, 5%	TY-OHM
R9	Chip Resistor, 1.0Ω, 1206, 1%	TY-OHM
R10	Chip Resistor, 80.6kΩ, 0805, 5%	TY-OHM
R11	Chip Resistor, 3.9kΩ, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
T1	Transformer, L_P = 1.55mH±7%, EPC13 5+5pin	
U1	IC, ACT334US-T, SOT23-6	Active-Semi

Transformer Specitication



Build up

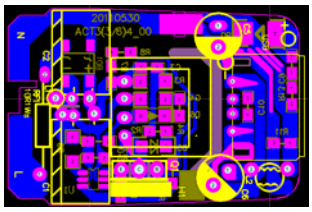
Wind-ing	Terminal		Turns	Wire			Insulation	
	Start	Fin-ish		Type	Size*QTY	Layer	Thick/Wide	Lay er
P1	4	-->	49	2UEW	0.12Φ*1	1	0.025*8.5W	
	<--	<--	49	2UEW	0.12Φ*1	1	0.025*8.5W	
	-->	1	49	2UEW	0.12Φ*1	1	0.025*8.5W	
SH1	2	NC	49	2UEW	0.12Φ*1	1	0.025*8.5W	
P2	2	3	24	2UEW	0.12Φ*1	1	0.025*8.5W	1
S1	10	6	9	TEX-E	0.40Φ*1	1	0.025*8.5W	2
SH2	2	Core	1					3

Note:1.SH1,SH2 are shielding; P1 & P2 are primary and S1 is secondary.(Bobbin:EPC13)

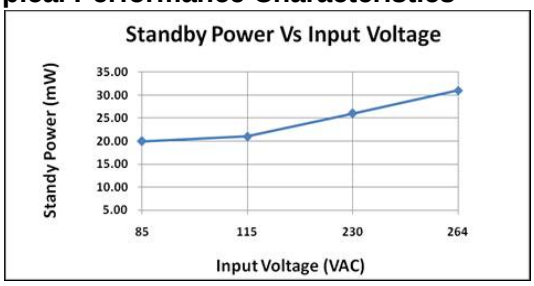
Electrical specifications

Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000Vac
2	P1 Inductance	Inductance between pins 1 and 4 at 1Vac & 1kHz	1.55mH±%7
3	P1 Leakage Inductance	Inductance between pins 1 and 4 with pins 2-3 and 6-10 shorted	75μH

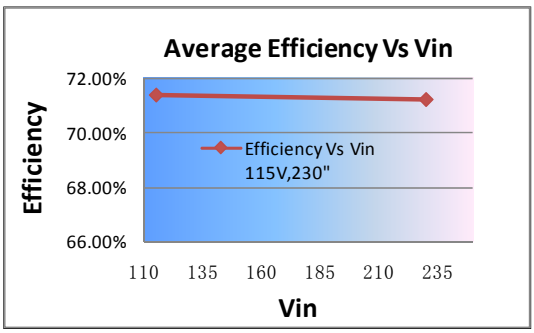
PCB Top and Bottom Layers



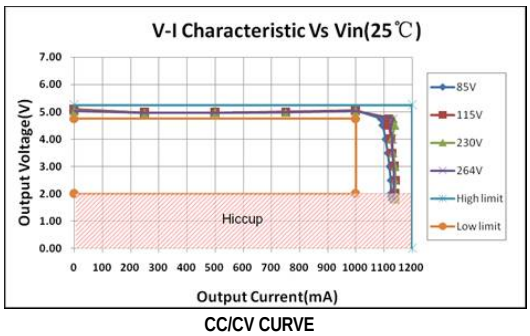
Typical Performance Characteristics



STANDBY POWER



EFFICIENCY

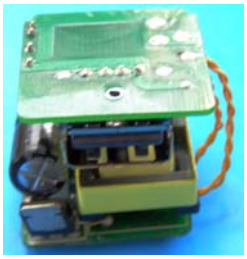


CC/CV CURVE

EVALUATION KITS	Vin	Vo	Io
ACT334-02	85-264Vac	4.75-5.25V	1000-1200mA

ACT336 5V/1200MA CHARGER

Input Voltage	Device	Standby Power	Output Voltage	Power output	Transformer	Topology
85-264VAC	ACT336	30mW	5V	7W	EFD15	Flyback



L=26.4mm
W=24.4mm
H=26.0mm

Operation and Application

Figure 1 is the schematic of an offline charger using ACT336 to provide output power of 5V1200mA. This circuit is a typical flyback power supply which includes the AC rectified circuit (BD1,C1, L2,C2),power drive circuit (BD pin, Q1), secondary rectified circuit (D8, C5,C6) and the IC control circuit. ACT336 is a Primary Side Regulator (PSR) so that the power supply unit can regulate current and voltage without Opto-coupler. Pin 6 and Pin 2,4,7 are the VDD and ground pins to provide power for the IC. Pin 8 is the base drive for the NPN transistor. Pin 1 is the switching pin. Pin 5 is the feedback pin that senses the output current and output voltage. Pin 3 is the peak current sense pin. Resistance of R10 determines the output DC cord compensation percentage.

This circuit can be used as universal charger for Cell Phones, PDAs, MP3,Portable Media Players, Shaver, DSCs, and Other Portable Devices and Appliances.

Key Component Selection

The maximum output current is decided by formula (1).

$$I_{OUTCC} = \frac{1}{2} \times L_P \times \left(\frac{0.9 * 0.396}{R_{CS}}\right)^2 \times \left(\frac{\eta \times F_{SW}}{V_{OUTCC}}\right) \quad (1)$$

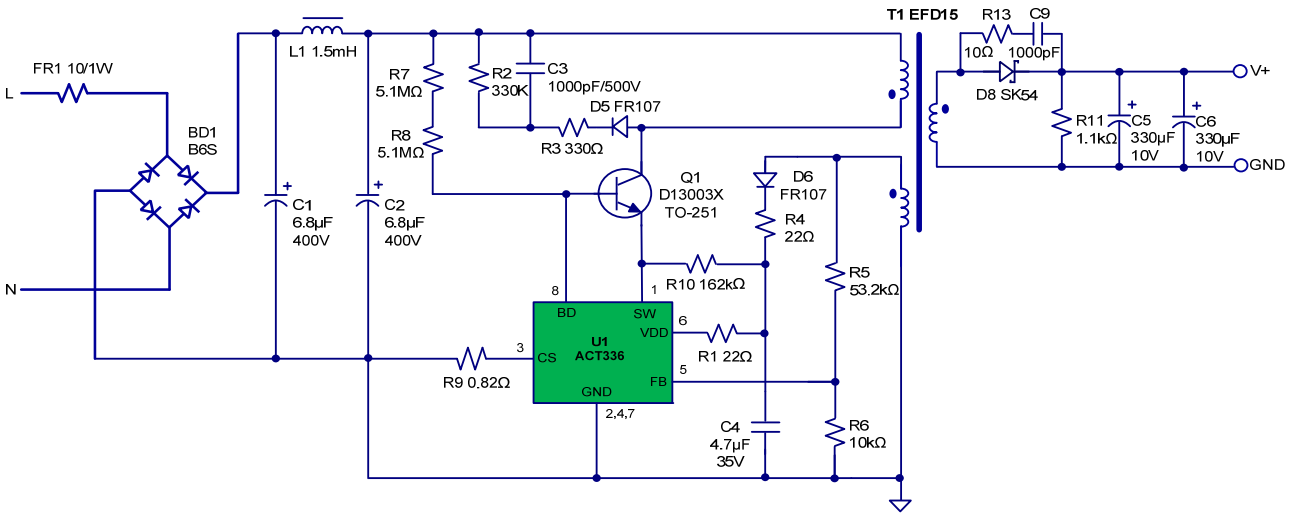
Lp is the transformer inductance value, Rcs is the current sense resistor, which is shown as R9 in the schematic. Fsw is the switching frequency, which design value is 75kHz.η is the overall system efficiency, which value is approximately equal to 70%. Voutcc is the output voltage, which setting is through the flyback voltage of auxiliary winding and the feedback resistor R5, R6 as shown in formula (2).

$$V_{OUTCC} = V_{REF} \times \left(1 + \frac{R_5}{R_6}\right) \times \frac{N_S}{N_{AUX}} - V_{SEC\_R} \quad (2)$$

Np/Ns/Naux (140/8/23) must be designed correctly to ensure it operates in DCM in all conditions. A design value Voutcc equal to 5V and Ioutcc_min equal to 1200mA are used to do the design. Ns and Naux are number of turns of secondary and auxiliary of the transformer. VSEC_R is the forward voltage drop of the output rectifier diode at approximately 0.1A bias. The peak current limit is set by (0.396×0.9)/Rcs.

Figure 1:

Schematic of Charger

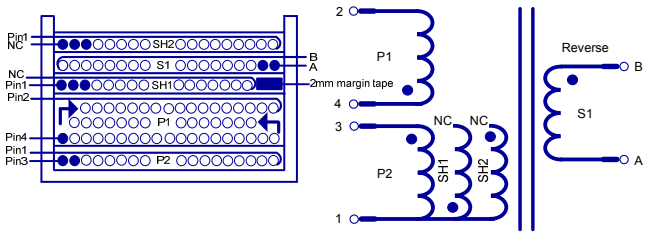


ACT336 5V/2100MA CHARGER

Bill of Materials

REF	DESCRIPTION	MFTR
C1,C2	Capacitor, Electrolytic, 6.8μF/400V, 8x12mm	Koshin
C3	Capacitor, Ceramic,220pF/500V,0805,SMD	POE
C4	Capacitor, Ceramic,4.7μF/35V,0805,SMD	POE
C5,C6	Capacitor, Electrolytic, 330μF/10V, 8x12mm	KSC
C9	Capacitor, Ceramic,1000pF/50V,0805,SMD	POE
BD1	Bridge,B6S,600V/0.5A,MDI,SMD	PANJIT
D5,D6	Diode,Ultra Fast, FR107,1000V/1.0A,DO-41	Good-Ark
D8	Diode, schottky, 40V/5A, SK54, SMC	PANJIT
L1	Axial Inductor, 1.5mH,0410,Dip	Amode Tech
Q1	Transistor, HFE 20-25, NPN,D13003X,TO-251	Huawei
PCB1	PCB, L*W*T=26.4x24.4x0.8mm,Cem-1,Rev:A	Jintong
FR1	Wire Round Resistor,1W,10 ohm,KNP, 5%	TY-OHM
R1	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R2	Chip Resistor, 1MΩ, 0805, 5%	TY-OHM
R3	Chip Resistor, 330Ω, 0805, 5%	TY-OHM
R4	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R5	Chip Resistor, 65kΩ, 0805,1%	TY-OHM
R6	Chip Resistor, 11.3kΩ, 0805,1%	TY-OHM
R7,R8	Chip Resistor, 15MΩ, 1206, 5%	TY-OHM
R9	Chip Resistor, 0.91Ω, 1206,1%	TY-OHM
R10	Chip Resistor, 162kΩ, 0805, 5%	TY-OHM
R11	Chip Resistor, 3.6kΩ, 0805, 5%	TY-OHM
R13	Chip Resistor, 10 ohm, 0805, 5%	TY-OHM
T1	Transformer, Lp=1.53mH, EFD15	
U1	IC, ACT336SH,SOP-8	Active-Semi.

Transformer Specitication



Build up

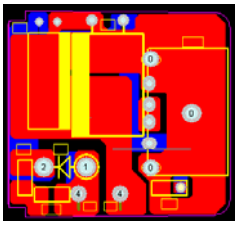
Winding	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QTY	Layer	Thick/Wide	Layer
P2	3	1	23	2UEW	0.12Φ*2	1	0.025*8.5W	2
P1	4	-->	47	2UEW	0.15Φ*1	1	0.025*8.5W	2
	<--	<--	47	2UEW	0.15Φ*1	1	0.025*8.5W	
	-->	2	46	2UEW	0.15Φ*1	1	0.025*8.5W	
SH1	1	NC	17	2UEW	0.12Φ*3	1	0.025*8.5W	2
S1	A	B	8	TEX-E	0.30Φ*2	1	0.025*8.5W	2
SH2	NC	1	21	2UEW	0.12Φ*3	1	0.025*8.5W	2

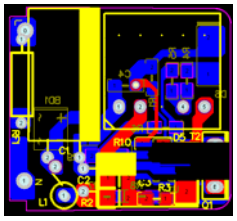
Note:1.SH1 and SH2 are shielding; P1 ,P2 and P3 are primary and S1 is secondary.(Bobbin:EFD15)

Electrical specifications

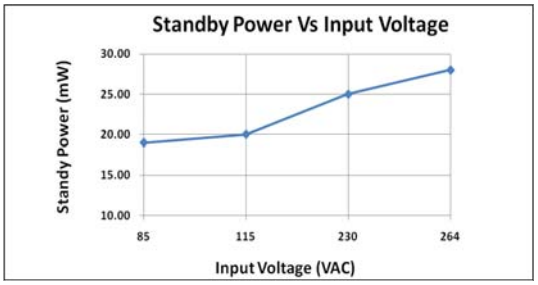
Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000Vac
2	P1 Inductance	Inductance between pins 2 and 4 at 1Vac & 1kHz	1.53mH±%7
3	P1 Leakage Inductance	Inductance between pins 1 and 3 with pins 2-4 and A-B shorted	75μH

PCB Top and Bottom Layers

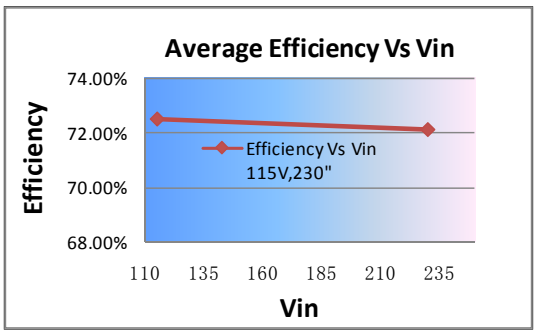




Typical Performance Characteristics



STANDBY POWER



EFFICIENCY

EVALUATION KITS	Vin	Vo	Io
ACT336-01	85-264Vac	4.75-5.25V	>1200mA

ACT337 5V/1500MA CHARGER

Input Voltage	Device	Standby Power	Output Voltage	Power output	Transformer	Topology
85-264VAC	ACT337	30mW	5V	7.5W	EE16	Flyback

L=50.6mm
W=26.2mm
H=20.9mm

Operation and Application

Figure 1 is the schematic of an offline charger using ACT337 to provide output power of 5V/1500mA. This circuit is a typical flyback power supply which includes the AC rectified circuit (BD1,C1, L2,C2),power drive circuit (BD pin, Q1), secondary rectified circuit (D8, C5,C6) and the IC control circuit. ACT337 is a Primary Side Regulator (PSR) so that the power supply unit can regulate current and voltage without Opto-coupler. Pin 6 and Pin 2,4,7 are the VDD and ground pins to provide power for the IC. Pin 8 is the base drive for the NPN transistor. Pin 1 is the switching pin. Pin 5 is the feedback pin that senses the output current and output voltage. Pin 3 is the peak current sense pin. Resistance of R10 determines the output DC cord compensation percentage.

This circuit can be used as universal charger for Cell Phones, PDAs, MP3,Portable Media Players, Shaver, DSCs, and Other Portable Devices and Appliances.

Key Component Selection

The maximum output current is decided by formula (1).

$$I_{OUTCC} = \frac{1}{2} \times L_P \times \left(\frac{0.9 * 0.396}{R_{CS}}\right)^2 \times \left(\frac{\eta \times F_{SW}}{V_{OUTCC}}\right) \quad (1)$$

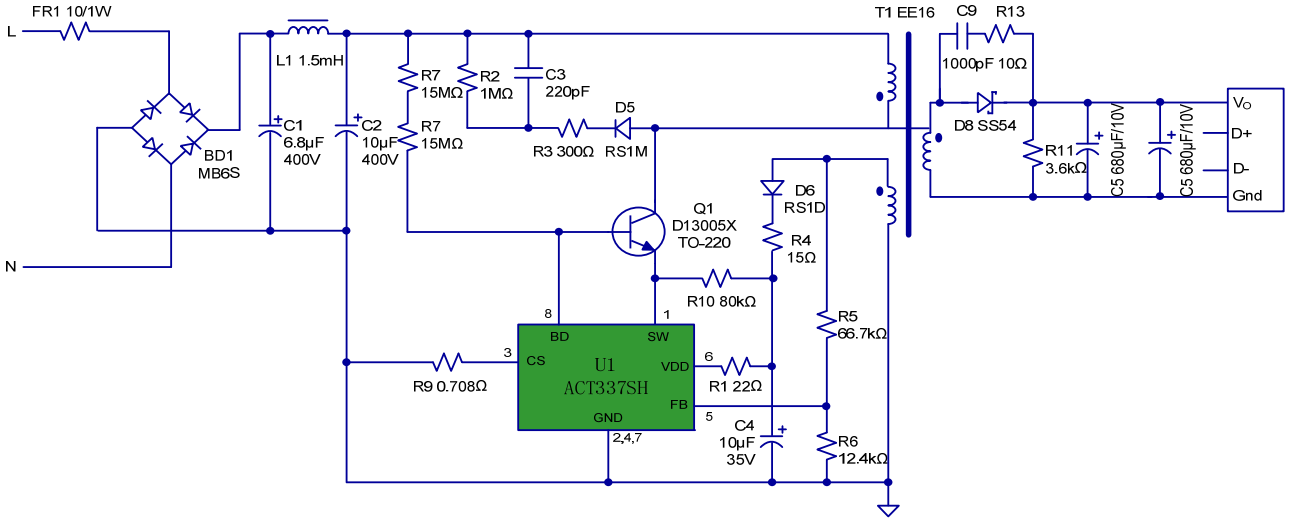
Lp is the transformer inductance value, Rcs is the current sense resistor, which is shown as R9 in the schematic. Fsw is the switching frequency, which design value is 75kHz.η is the overall system efficiency,which value is approximately equal to 70%. Voutcc is the output voltage, which setting is through the flyback voltage of auxiliary winding and the feedback resistor R5, R6 as shown in formula (2).

$$V_{OUTCC} = V_{REF} \times \left(1 + \frac{R_5}{R_6}\right) \times \frac{N_S}{N_{AUX}} - V_{SEC\_R} \quad (2)$$

Np/Ns/Naux (110/8/18) must be designed correctly to ensure it operates in DCM in all conditions. A design value Voutcc equal to 5V and Ioutcc_min equal to 1500mA are used to do the design. Ns and Naux are number of turns of secondary and auxiliary of the transformer. VSEC_R is the forward voltage drop of the output rectifier diode at approximately 0.1A bias. The peak current limit is set by (0.396×0.9)/Rcs.

Figure 1:

Schematic of Charger

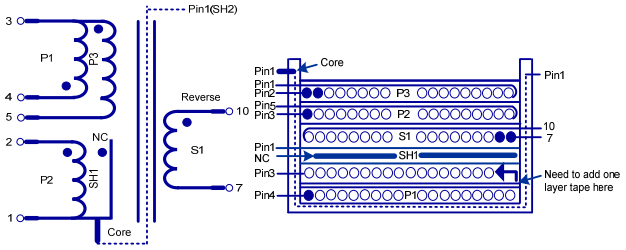


ACT337 5V/1500MA CHARGER

Bill of Materials

REF	DESCRIPTION	MFTR
C1	Capacitor, Electrolytic, 6.8μF/400V, 8×14mm	Koshin
C2	Capacitor, Electrolytic, 10μF/400V,10×14mm	Koshin
C3	Capacitor, Ceramic,220pF/500V,1206,SMD	POE
C4	Capacitor, Electrolytic, 10μF/35V,5x11mm	KSC
C5,C6	Capacitor, Electrolytic,680μF/10V, 8 ×16mm	KSC
C9	Capacitor, Ceramic,1000pF/50V,0805,SMD	POE
BD1	Bridge Rectifier,MB6S,600V/1.0A,SDIP	PANJIT
D5	Fast Recovery Rectifier, FR107,1000V/1.0A, DIP	PANJIT
D6	Fast Recovery Rectifier,RS1D,200V/1.0A,SMA	PANJIT
D8	Diode, Schottky, 40V/5A, SS54, SMC	Diodes
L1	Choke Coil, 1.5mH, ¢6x8mm, DIP	Amode Tech
PCB1	PCB, L*W*T=50x26x1.6mm,Cem-1,Rev:A	Jintong
Q1	Transistor, NPN, 700V,D13005,TO-220	Huawei
FR1	Fusible Resistor, 1W, 10Ω, 5%	TY-OHM
R1	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R2	Chip Resistor, 1M,1206, 5%	TY-OHM
R3	Chip Resistor, 300Ω,1206, 5%	TY-OHM
R4	Chip Resistor, 15Ω, 0805, 5%	TY-OHM
R5	Chip Resistor, 66.7kΩ, 0805, 1%	TY-OHM
R6	Chip Resistor,12.4kΩ, 0805, 1%	TY-OHM
R7,R8	Chip Resistor, 15MΩ, 1206, 5%	TY-OHM
R9	Chip Resistor, 0.708Ω,1206, 1%	TY-OHM
R10	Chip Resistor, 80k, 0805, 5%	TY-OHM
R11	Chip Resistor, 3.6k, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
T1	Transformer, L_P = 1.15mH±7%, EE16	
USB	Double-layer USB Rev:A	
U1	IC, ACT337SH-T,SOP-8	Active-Semi

Transformer Specitication



Build up

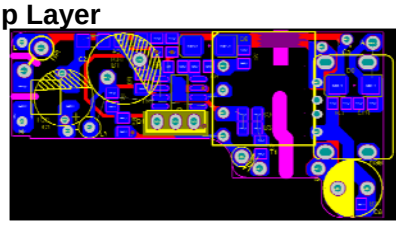
Winding	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QTY	Layer	Thick/Wide	Layer
P1	2	3	74	2UEW	0.22Φ*1	1	0.025*8.5W	2
SH1	-->	4	0.9	Copper	0.7mm	1	0.025*8.5W	2
S1	B	A	8	TEX-E	0.75Φ*1	1	0.025*8.5W	2
P2	5	4	18	2UEW	0.14¢*3	1	0.025*8.5W	2
P3	3	1	36	2UEW	0.22¢*1	1	0.025*8.5W	2
SH2	4	core	3	Copper wire	0.15Φ*1	1	0.025*8.5W	8

Note:1.SH1 and SH2 are shielding; P1 ,P2 and P3 are primary and S1 is secondary.(Bobbin:EE16)

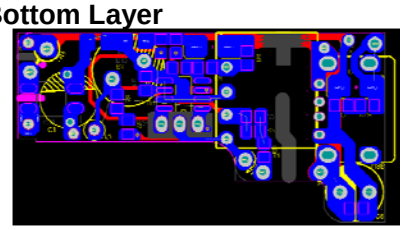
Electrical specifications

Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000Vac
2	P1 Inductance	Inductance between pins 2 and 3 at 1Vac & 1kHz	1.15mH±%7
3	P1 Leakage Inductance	Inductance between pins 2 and 3 with pins 4-5 and 6-10 shorted	75μH

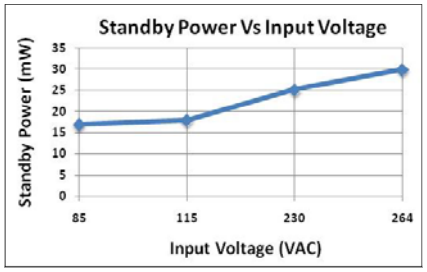
PCB Top Layer



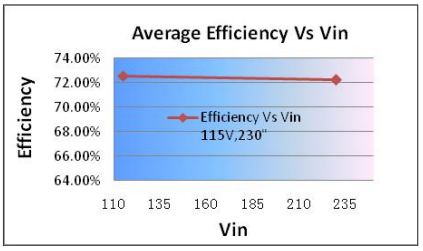
PCB Bottom Layer



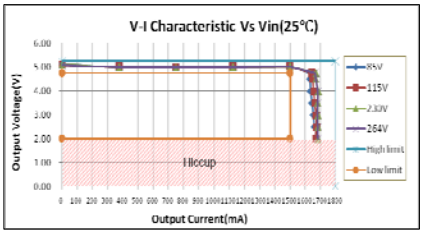
Typical Performance Characteristics



STANDBY POWER



EFFICIENCY



CC/CV CURVE

EVALUATION KITS	Vin	Vo	Io
ACT337-01	85-264Vac	4.75-5.25V	1500-1800mA

ACT337 5V/2100MA CHARGER

Input Voltage	Device	Standby Power	Output Voltage	Power output	Transformer	Topology
85-264VAC	ACT337	30mW	5V	10.5W	EPC17	Flyback

L=40.0mm
W=27.9mm
H=22.0mm

Operation and Application

Figure 1 is the schematic of an offline charger using ACT337 to provide output power of 5V2100mA. This circuit is a typical flyback power supply which includes the AC rectified circuit (BD1,C1, L2,C2),power drive circuit (BD pin, Q1), secondary rectified circuit (D8, C5,C6) and the IC control circuit. ACT337 is a Primary Side Regulator (PSR) so that the power supply unit can regulate current and voltage without Opto-coupler. Pin 6 and Pin 2,4,7 are the VDD and ground pins to provide power for the IC. Pin 8 is the base drive for the NPN transistor. Pin 1 is the switching pin. Pin 5 is the feedback pin that senses the output current and output voltage. Pin 3 is the peak current sense pin. Resistance of R10 determines the output DC cord compensation percentage.

This circuit can be used as universal charger for Cell Phones, PDAs, MP3,Portable Media Players, Shaver, DSCs, and Other Portable Devices and Appliances.

Key Component Selection

The maximum output current is decided by formula (1).

$$I_{OUTCC} = \frac{1}{2} \times L_P \times \left(\frac{0.9 * 0.396}{R_{CS}}\right)^2 \times \left(\frac{\eta \times F_{SW}}{V_{OUTCC}}\right) \quad (1)$$

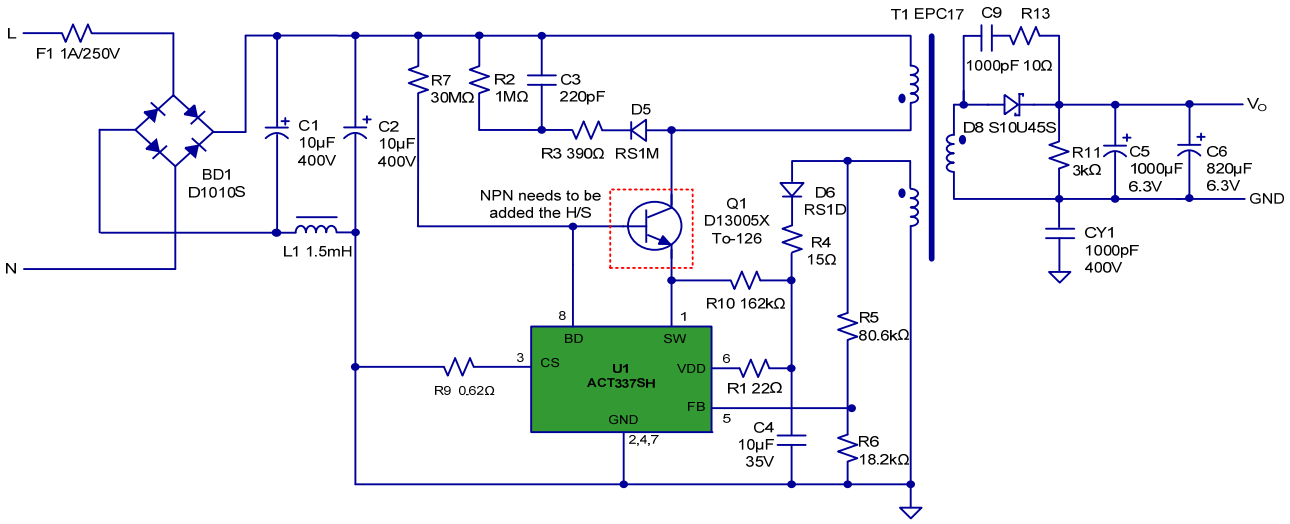
Lp is the transformer inductance value, Rcs is the current sense resistor, which is shown as R9 in the schematic. Fsw is the switching frequency, which design value is 75kHz.η is the overall system efficiency, which value is approximately equal to 70%. Voutcc is the output voltage, which setting is through the flyback voltage of auxiliary winding and the feedback resistor R5, R6 as shown in formula (2).

$$V_{OUTCC} = V_{REF} \times \left(1 + \frac{R_5}{R_6}\right) \times \frac{N_S}{N_{AUX}} - V_{SEC\_R} \quad (2)$$

Np/Ns/Naux (110/8/18) must be designed correctly to ensure it operates in DCM in all conditions. A design value Voutcc equal to 5V and Ioutcc_min equal to 2100mA are used to do the design. Ns and Naux are number of turns of secondary and auxiliary of the transformer. VSEC_R is the forward voltage drop of the output rectifier diode at approximately 0.1A bias. The peak current limit is set by (0.396×0.9)/Rcs.

Figure 1:

Schematic of Charger

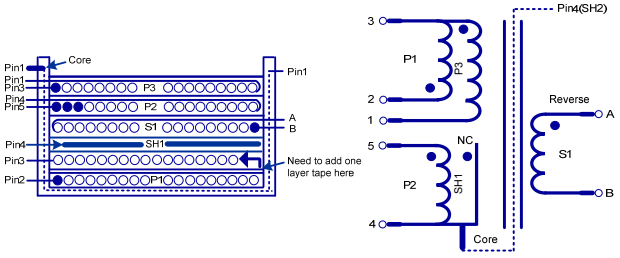


ACT337 5V/2100MA CHARGER

Bill of Materials

REF	DESCRIPTION	MFTR
C1, C2	Capacitor, Electrolytic, 10μF/400V, 10×16mm	KSC
C3	Capacitor, Ceramic,220pF/500V,1206,SMD	POE
C4	Capacitor, Ceramic, 10μF/35V,1206,SMD	KSC
C5	Capacitor, Electrolytic, 1000μF/6.3V, 8 ×16mm	KSC
C6	Capacitor, Electrolytic, 820μF/6.3V, 6.3 × 16mm	KSC
C9	Capacitor, Ceramic,1000pF/50V,0805,SMD	POE
CY1	Safety Y1,Capacitor,1000pF/400V,Dip	UXT
BD1	Bridge Rectifier,D1010S,1000V/1.0A,SDIP	PANJIT
D5	Fast Recovery Rectifier, RS1M,1000V/1.0A, RMA	PANJIT
D6	Fast Recovery Rectifier,RS1D,200V/1.0A,SMA	PANJIT
D8	Diode, Schottky, 45V/10A, S10U45S, SMD	Diodes
L1	Choke Coil, 1.5mH, ¢6x8mm, DIP	Amode Tech
PCB1	PCB, L*W*T=40x27.9x1.6mm,Cem-1,Rev:A	Jintong
Q1	Transistor, NPN, 700V,D13005,TO-126	Huawei
F1	Fuse:1A 250V 3.6*10mm With Pigtail, ceramic tube	walter
R1	Chip Resistor, 22Ω, 0805, 5%	TY-OHM
R2	Chip Resistor, 1MΩ,1206, 5%	TY-OHM
R3	Chip Resistor, 390Ω,1206, 5%	TY-OHM
R4	Chip Resistor, 15Ω, 0805, 5%	TY-OHM
R5	Chip Resistor, 80.6kΩ, 0805, 1%	TY-OHM
R6	Chip Resistor,18.2kΩ,0805, 1%	TY-OHM
R7	Chip Resistor, 30MΩ, 1206, 5%	TY-OHM
R9	Chip Resistor, 0.62Ω,1206, 1%	TY-OHM
R10	Chip Resistor, 162kΩ, 0805, 5%	TY-OHM
R11	Chip Resistor, 3kΩ, 0805, 5%	TY-OHM
R13	Chip Resistor, 10Ω, 0805, 5%	TY-OHM
T1	Transformer, LP = 1.25mH±7%, EPC17	
USB	Double-layer USB Rev:A	
S/H1	AL HeatSink, LxWxH=7.5x17x2.0mm	
U1	IC, ACT337SH-T,SOP-8	Active-Semi

Transformer Specitication



Build up

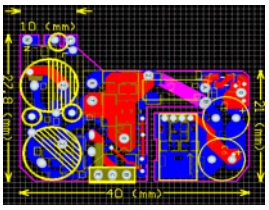
Wind-ing	Terminal		Turns	Wire			Insulation	
	Start	Finish		Type	Size*QTY	Layer	Thick/Wide	Lay er
P1	2	3	74	2UEW	0.22Φ*1	1	0.025*8.5W	2
SH1	-->	4	0.9	Copper	0.7mm	1	0.025*8.5W	2
S1	B	A	8	TEX-E	0.75Φ*1	1	0.025*8.5W	2
P2	5	4	18	2UEW	0.14¢*3	1	0.025*8.5W	2
P3	3	1	36	2UEW	0.22¢*1	1	0.025*8.5W	2
SH2	4	core	3	Copper wire	0.15Φ*1	1	0.025*8.5W	8

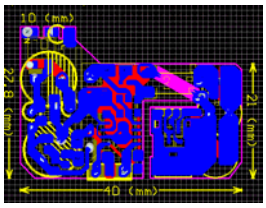
Note:1.SH1 and SH2 are shielding; P1 ,P2 and P3 are primary and S1 is secondary.(Bobbin:EPC17)

Electrical specifications

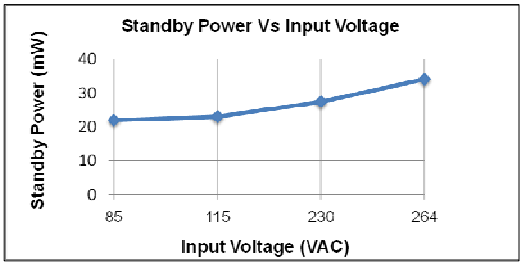
Item	Description	Condition	Limits
1	Electrical Strength	50Hz, 1 minute, from primary and secondary	3000Vac
2	P1 Inductance	Inductance between pins 2 and 3 at 1Vac & 1kHz	1.25mH±%7
3	P1 Leakage Inductance	Inductance between pins 2 and 3 with pins 4-5 and 6-10 shorted	75μH

PCB Top and Bottom Layers

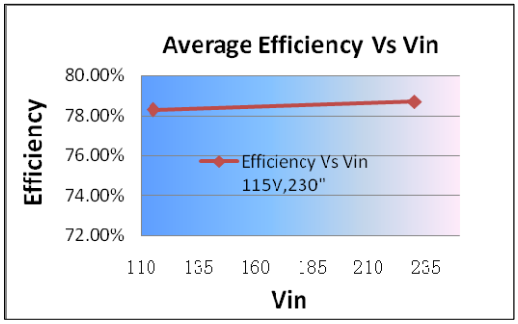




Typical Performance Characteristics



STANDBY POWER



EFFICIENCY

EVALUATION KITS	Vin	Vo	Io
ACT365-02	85-264Vac	4.75-5.25V	>2200mA

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